

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Title	Adaptive Filter Design	Course No				
Department/ Specialization	Electronics & Communication Engineering	Credits	L	T	P	C
			3	1	0	3
To be offered for	PG/Ph.D.	Status	Core	<input type="checkbox"/>	Elective	<input checked="" type="checkbox"/>
Faculty proposing the course	Dr. Asutosh Kar	Type	New	<input type="checkbox"/>	Revision	<input checked="" type="checkbox"/>
Recommendation from	the DAC - Yes	Date of DAC	17 th March 2021			
External Experts	Prof. CS Ramalingam, Dept. of EE, IIT Madras Prof. Trilochan Panigrahi, Dept. of ECE, NIT Goa					
Prerequisite	Signals and systems, DSP	Submitted for approval	46th Senate			
Learning Objectives	This course covers various aspects of adaptive filter theory along with applications in modern communication system design for channel equalization, echo cancellation, active noise control and feedback reduction which are prime focus of signal processing industries all over the world.					
Learning Outcomes	<ul style="list-style-type: none"> Solving industry relevant problems which will motivate them for further research in the field of signal processing and communication. The design aspect of adaptive filter will help them to realize the filter design applying the previously studied signal & systems. Hence, it will increase their interest on application based studies. 					
Course Contents (with approximate breakup of hours for lecture/tutorial)	<p>Background and preview: Brief background of modern signal analysis and representation techniques, the filtering problem, analog vs. digital filters, linear filter structures, strict sense and wide sense stationary process, spectrum analysis, and noise signal characterization. (12L+3T)</p> <p>Statistical signal processing: Practical characterization of stochastic process, MMSE estimators, mean ergodic theorem, correlation matrix, Autoregressive (AR), Moving Average (MA) and ARMA stochastic models, Wold's Decomposition, linear optimum filtering, and Wiener-Hopf equation. (12L+4T)</p> <p>Adaptive filtering algorithms: Wiener filter design and analysis, characteristics of adaptive algorithms, Gradient search/Newton's algorithm, Steepest descent algorithm, Least Mean Square (LMS) algorithm, Normalized LMS algorithm, Filtered-X LMS algorithm, last square methods and Recursive Least Square algorithm. (10L+4T)</p> <p>Applications: Acoustic echo cancellation, active noise cancellation, adaptive channel equalization for addressing inter symbol interference, and adaptive feedback cancellation. (8L+3T)</p>					
Text Books	<ol style="list-style-type: none"> Simon Haykin, Adaptive Filter Theory, Pearson Education, Fourth Edition, 2011. B. Widrow, S.D. Stearns, Adaptive Signal Processing, Pearson, 2012. A. H. Sayed, Adaptive Filters, Wiley, NJ, 2008. 					
Reference Books	<ol style="list-style-type: none"> Monson H. Hayes, Statistical Digital Signal Processing and Modeling, Wiley-India, 2008. D. Manolakis, M. Ingle, S. Kogon, Statistical and Adaptive Signal Processing, McGraw-Hill, 2000. 					